



New records of Merriam's Shrew (*Sorex merriami*) from western North Dakota

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Abstract: Despite having a broad geographic distribution, Merriam's Shrew (*Sorex merriami* Dobson 1890) is known from a relatively few, widely-scattered localities. In North Dakota, the species was known from only a single poorly-preserved specimen collected in 1913 near Medora. We recently collected two new specimens of Merriam's Shrew from Billings and McKenzie counties in the western quarter of the state. These specimens confirm the presence of *S. merriami* in North Dakota and better define the northeastern edge of the species' distribution.

Key words: geographic range, Great Plains, prairie dog town, *Cynomys*

Merriam's Shrew (*Sorex merriami* Dobson 1890) is broadly distributed throughout western North America, occurring from southern British Columbia to southern Arizona, and from North Dakota, Nebraska and New Mexico west to California, Oregon, and Washington (Seabloom 2011). The species occurs in drier habitats and generally is associated with sagebrush steppes and open grasslands (Hafner and Stahlecker 2002). Throughout its range, *S. merriami* typically is encountered with low frequency, and it is uncommon along the eastern edge of its distribution (Hoffmeister 1956). Southwestern North Dakota represents the northeastern limits of the range of Merriam's Shrew (Armstrong and Jones 1971; Hall 1981), and its presence there was documented by a single individual collected in 1913 near Medora, Billings County. This specimen lacks a skull and was identified based on pelage coloration (Jackson 1921). Herein, we report on two additional specimens of *S. merriami* from southwestern North Dakota obtained nearly a century after the species was first recorded in the state. Our recent captures confirm the presence of the species in the

state and help us to better understand the northeastern limits of Merriam's Shrew.

We surveyed for small mammals during two summers in western North Dakota, as part of a larger project examining mammalian communities associated with Black-tailed Prairie Dog (*Cynomys ludovicianus*) towns. Sampling was conducted in Billings and Stark counties from 11–16 July and 18–23 July 2011, respectively, and in Slope and McKenzie counties from 9–14 July and 16–21 July 2012, respectively. Small mammals were collected using pitfall arrays consisting of 10 pitfalls (≥ 14 cm in diameter and 19 cm in depth) arranged in the shape of a "Y" separated by 5 m of staked, plastic drift fencing (Kirkland and Sheppard 1994). Pitfall arrays were operated for five consecutive nights and checked daily. Five pitfall arrays were operated during each sampling period, resulting in 1,000 total trap-nights of sampling effort. Voucher specimens were deposited in the Dickinson State University Natural History Collection, Dickinson, ND (DSU), and the National Museum of Natural History, Washington, DC (USNM).

In addition to *S. merriami*, the Prairie Shrew (*Sorex haydeni* Baird, 1857) is the only other shrew in the genus *Sorex* known to occur in western North Dakota. *Sorex haydeni* occurs throughout the state (Seabloom 2011). The Dwarf Shrew (*S. nanus*) potentially could occur in southwestern North Dakota, but its presence there has not been documented. A number of qualitative and quantitative characters distinguish *S. merriami* from the other two species (Junge and Hoffmann 1981). Like other members of the subgenus *Sorex*, *S. merriami* typically has an obvious postmandibular foramen, and it lacks a pigmented ridge on the lingual cingulum of each unicuspid. The other two species, both members of the subgenus *Otisorex*, tend to have a pigmented ridge on the lingual cingulum of the unicuspid and lack an obvious postmandibular foramen. In addition,

both *S. haydeni* and *S. nanus* have an obvious medial tine on the anterior face of the upper first incisor, whereas *S. merriami* lacks this character. *Sorex merriami* averages a longer skull [condylobasal length of skull (CBL) = 15.0–17.1, see Table 1 and Junge and Hoffmann 1981] than either *S. haydeni* (CBL = 14.1–15.6) or *S. nanus* (CBL = 13.8–14.8). These characters confirmed the identity of one of our specimens (USNM 600399). Unfortunately, the teeth of the other (DSU 691) are worn, and the skull is incomplete, thus complicating its identification. We instead plotted breadth across the palate (measured as the greatest width across the upper second molars) against length of palate for 20 *S. haydeni* from North Dakota, 11 *S. merriami* from throughout its distribution, and the two new specimens.

Eighteen small mammals were captured in Billings County ($n = 11$) and Stark County ($n = 7$). Prairie Voles (*Microtus ochrogaster*) were the most commonly captured small mammal ($n = 7$). In addition, four shrews were collected during the sampling period. Our specimen of *S. merriami* (DSU 691) was collected on the morning of 14 July 2011 at the Billings County site. *Sorex haydeni* ($n = 2$) were collected at this site along with individuals of the Short-tailed Shrew (*Blarina brevicauda*), Northern Pocket Gopher (*Thomomys talpoides*) and Prairie Voles. Also captured during this period were Deer Mice (*Peromyscus maniculatus*; $n = 3$) and single specimens of the Northern Grasshopper Mouse (*Onychomys leucogaster*), the Hispid Pocket Mouse (*Cheatomipus hispidus*) and the Olive-backed Pocket Mouse (*Perognathus fasciatus*).

The *S. merriami* capture site in Billings County, was on the side of a hill with a southwestern exposure (aspect 215°; slope 30%) 17.2 km north and 3.7 km east of Medora (elevation 745 m; 47°04'01.56" N, 103°28'13.44" W). Living plants occupied from 30–50% of the prairie dog town area, with the majority consisting of native perennials. The locality is dominated by forbs but was surrounded by grasslands composed primarily of Western Wheatgrass (*Pascopyrum smithii*) and Blue Grama (*Bouteloua gracilis*).

Thirty-eight forbs and grasses (six non-native species) were identified at this prairie dog town. The dominant forbs on the site were Fringed Sage (*Artemisia frigida*) and White Sage (*Artemisia ludoviciana*), whereas, less common forbs included Cut-leaf Goldenweed (*Haplopappus spinulosus*), Scarlet Globemallow (*Sphaeralcea coccinea*), Scarlet Gaura (*Gaura coccinea*), Prostrate Vervain (*Verbena bracteata*) and White Milkwort (*Polygala alba*).

Common grasses on the prairie dog town were Blue Grama (*Bouteloua gracilis*), Western Wheatgrass (*Pascopyrum smithii*), Smooth Brome (*Bromus inermis*), Inland Saltgrass (*Distichlis spicata*), and Japanese Brome (*Bromus japonicus*). Horizontal Juniper (*Juniperus horizontalis*) and Western Snowberry (*Symphoricarpos occidentalis*) occurred along the edges of the site. Other notable plants occurring at this site included Plains Prickly Pear (*Opuntia polyacantha*), Silver Sage (*Artemisia argentea*) and Foxtail Barley (*Hordeum jubatum*).

Sixteen small mammals were captured in McKenzie County ($n = 6$) and Slope County ($n = 10$). *Sorex haydeni* ($n = 7$) and *P. maniculatus* ($n = 6$) were the two most

Table 1. External and skull measurements (mm) of *Sorex*. Statistics are mean \pm SD and range.

| | <i>Sorex haydeni</i> | <i>Sorex merriami</i> | DSU 691 | USNM 600399 |
|------------------------------|---|--|-------------|-------------|
| | ($n = 29$) | ($n = 9$) | ($n = 1$) | ($n = 1$) |
| External Measurements | | | | |
| Head and body length (HB) | 56 \pm 5 48 – 64 | 63 \pm 9 49 – 77 | 55 | 61 |
| Tail length (TL) | 35 \pm 4 29 – 42 | 39 \pm 3 32 – 42 | 40 | 38 |
| Tail as % of head & body | 63 \pm 8 46 – 76 | 62 \pm 10 51 – 84 | 73 | 62 |
| Length of Hind Foot (HF) | 11 \pm 1 10 – 13 | 12 \pm 1 11 – 13 | 12 | 12 |
| Weight (WT) | 2.9 \pm 0.5 2.6 – 3.6 ($n = 4$) | — | 5 | 3.6 |
| Skull measurements | ($n = 20$) | ($n = 10$) | ($n = 1$) | ($n = 1$) |
| Condylobasal length (CBL) | 15.3 \pm 0.2 14.9 – 15.6 ($n = 12$) | 16.3 \pm 0.5 15.5 – 17.1 ($n = 9$) | — | 16.4 |
| Breadth of braincase (BB) | 7.4 \pm 0.2 7.2 – 7.7 ($n = 12$) | 8.3 \pm 0.2 8.0 – 8.6 ($n = 8$) | — | 8.4 |
| Maxillary breadth (MXB) | 4.1 \pm 0.1 3.9 – 4.3 | 5.1 \pm 0.1 4.8 – 5.3 ($n = 9$) | 5.2 | 5.1 |
| Breadth across M2s (M2B) | 3.8 \pm 0.1 3.6 – 4.0 | 5.0 \pm 0.1 4.8 – 5.2 | 4.9 | 4.9 |
| Length of palate (PL) | 6.4 \pm 0.2 6.0 – 6.8 | 7.3 \pm 0.3 6.8 – 7.8 | 7.7 | 7.2 |

commonly captured species. Our second specimen of *S. merriami* (USNM 600399) was collected on the morning of 17 July 2012 in McKenzie County. Single specimens of *T. talpoides* and *P. fasciatus* were also captured at the site.

The *S. merriami* capture site in McKenzie County), was on the upslope of a draw with an eastern exposure (aspect 110°, slope 5%) 8.5 km south and 56.4 km west of Watford City (elev. 620 m; 47°43'49.06" N, 104°01'56.04" W). Vegetation analyses were conducted after the identification of the specimen had been verified, several months after its capture. By that time, the site had been severely affected by drought. The slope was dominated by grasses composed primarily of Inland Saltgrass and Western Wheatgrass. Other grasses included Blue Grama, Threadleaf Sedge (*Carex filifolia*), Alkali Cordgrass (*Spartina gracilis*), and Prairie Dropseed (*Sporobolus heterolepis*). Average height of grasses on the site was ≤ 8 cm. We did not observe Japanese Brome and Cheatgrass (*Bromus tectorum*) during our vegetation assessment, due to drought conditions. It is likely that both occurred on the site as both are well-established, invasive plants common on North Dakota grasslands.

The forb community at the site included at least 14 species and was dominated by Fringed Sage and Winterfat (*Krascheninnikovia lanata*). Also present were Plains Prickly Pear, White Aster (*Symphyotrichum ericoides*), Scarlet Globemallow, Green Milkweed (*Asclepias viridiflora*), Western Yarrow (*Achillea millefolium*), and Slender Cinquefoil (*Potentilla gracilis*).

Comparisons of palatal breadth against palatal length distinguished *S. haydeni* from *S. merriami*, a result of *S. merriami*'s longer and wider palate. Both of our specimens from North Dakota group with *S. merriami*,

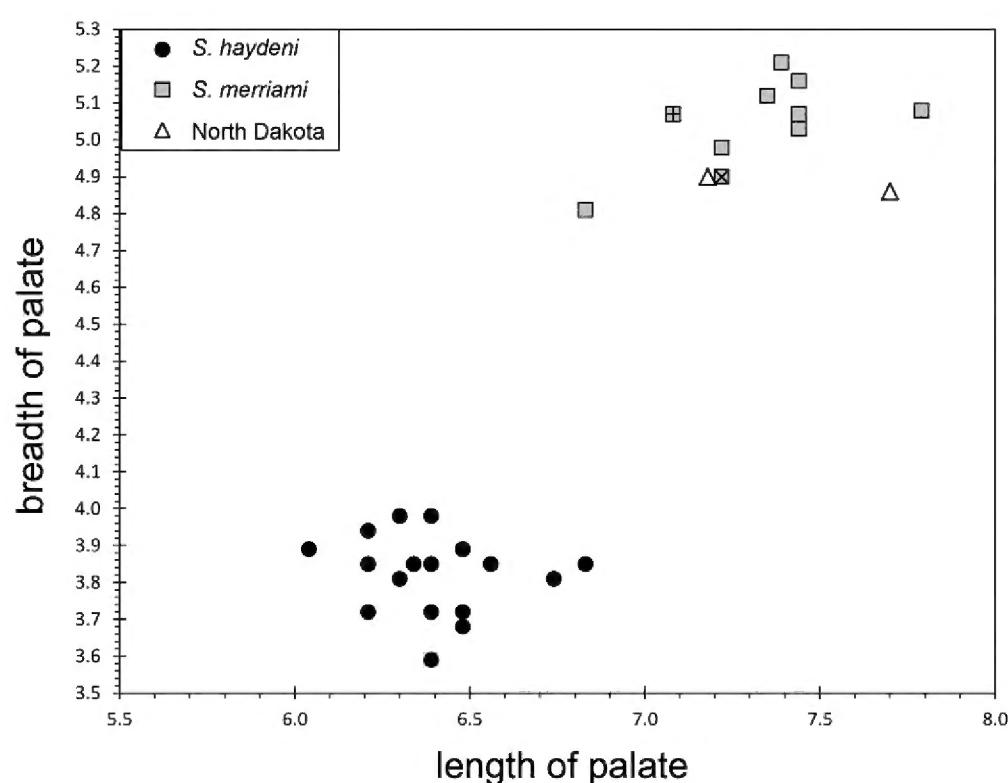


Figure 1. Plot of breadth of palate and length of palate for *Sorex haydeni* and *S. merriami*. The two new specimens of *S. merriami* from North Dakota are plotted as open triangles. The specimen marked with an "X" is the holotype of *S. merriami* from Montana; that marked with a "+" is the holotype of *S. leucogenys* from Utah. *Sorex leucogenys* is currently recognized as a subspecies of *S. merriami* (Hall 1981; Hutterer 2005).

confirming our identification of this species (Figure 1).

The first specimen of Merriam's Shrew (USNM 202019) to be collected from North Dakota was a female found dead on 13 June 1913 among the rocks on top of a high butte near Medora, Billings County, North Dakota. It had been partly eaten, and the head was missing (Bailey et al. 1914; Smithsonian Institution Archives, RU 7176, U.S. Fish and Wildlife Service, Field Reports, Box 80). Because of the condition of the specimen, the external measurements are incomplete, and there is no skull. It was identified by its pale dorsal pelage and distinctly whitish underparts and feet (Jackson 1921). At the time, the only other specimen of the species known was the holotype (USNM 186441), collected on 26 December 1884 in the garden of a military post, about 1.5 miles along the Little Bighorn River above Fort Custer, Montana (Miller 1895). The headless individual from North Dakota was only the second specimen known for the species, and it greatly extended the known distribution of *S. merriami* to the east. The identity of this individual has been questioned, however, as a result of the incompleteness of the specimen (Diersing and Hoffmeister 1977). Our new specimen from near Medora confirms this earlier record and adjusts the geographic range of the species slightly to the east by 5.6 km, out of the

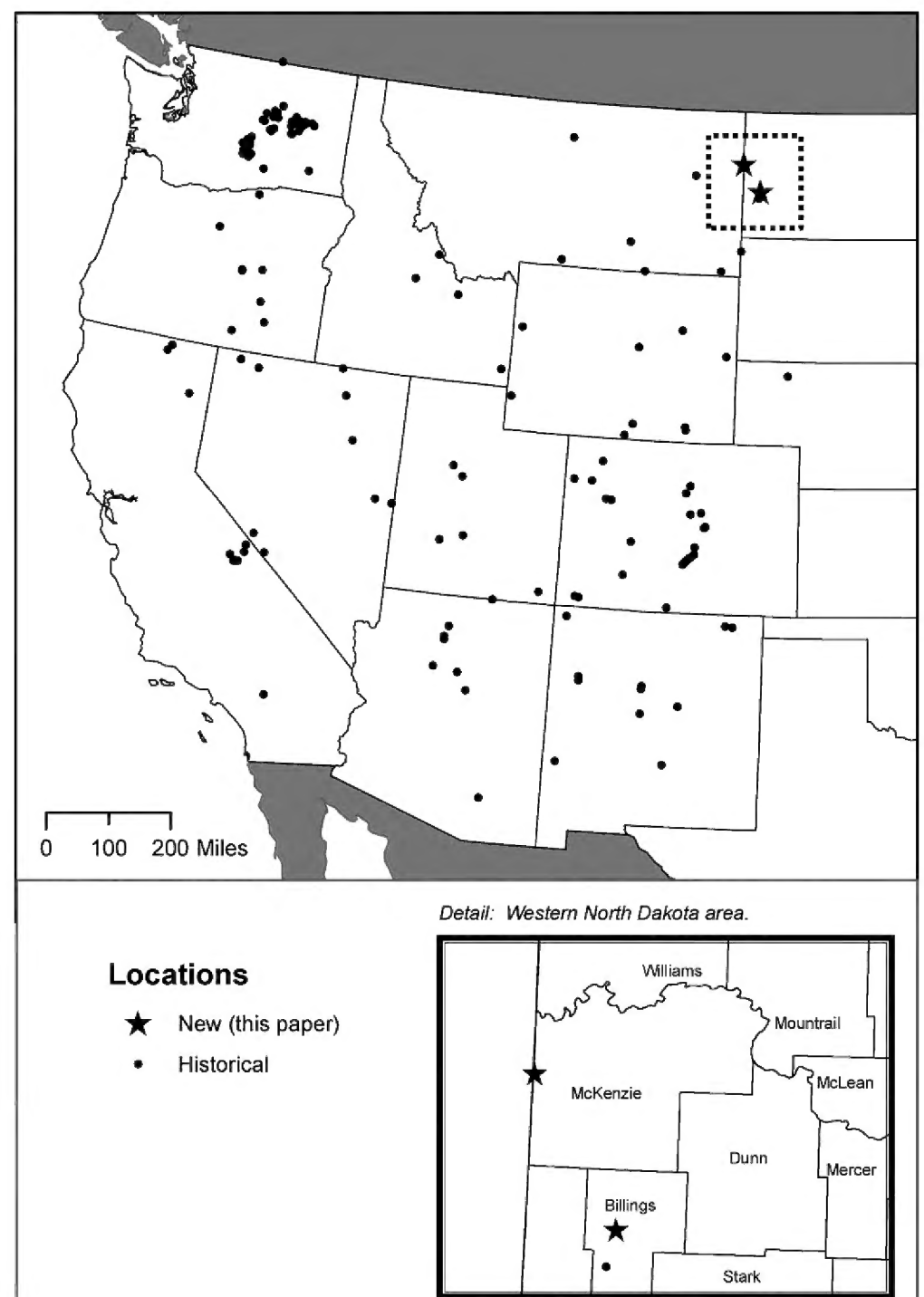


Figure 2. Revised distribution of Merriam's Shrew (*Sorex merriami*) in North America.

immediate valley of the Little Missouri River and into the North Dakota badlands (Figure 2). The new specimen from McKenzie County further extends the northern limit of this distribution by 98 km.

Sorex merriami is generally considered to be associated with sagebrush-steppe environments and, anecdotally, with Big Sagebrush (*Artemisia tridentata*) (Williams 1984; Ports and McAdoo 1986; Hafner and Stahlecker 2002). Whereas big sagebrush does not occur at either of the sites where we captured *S. merriami*, three other species of sage (Fringed Sage, White Sage and Silver Sage) are present at the prairie dog towns in Billings County and fringed sage occurs in McKenzie County. An apparent association exists between sage-dominated habitats and the presence of Merriam's Shrew (Armstrong and Jones 1971; Williams 1984; Ports and McAdoo 1986; Kirkland *et al.* 1997; Hafner and Stahlecker 2002). Sages may be important to the habitat requirements of Merriam's Shrew or they may simply be indicative of abiotic characteristics of the environment that favor the shrew's presence.

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Authors' contribution statement: MS carried out field work that resulted in the collection of the new specimens and the vegetation analyses, produced the updated range map, and made the initial field identifications. NW measured the specimens, conducted analyses to verify the identification, and did historical archival research. MS and NW together wrote the text.

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Appendix 1. Specimens examined.

Sorex merriami (*n* = 14). — Colorado: Gunnison Co.; 5.8 mi NW Gunnison, Maggie Gulch [USNM 485301, 498396–498399]. Montana: Big Horn Co.; Fort Custer [USNM 186441—holotype]. Nevada: Elko Co.; Golconda, Desert Ranch, 100 mi NE [USNM 210121]. North Dakota: Billings Co.; Medora [USNM 202019]; 17.19 km N, 3.67 km E Medora, 745m [DSU 691]. McKenzie Co.; 8.4 km S, 56.4 km W Watford City, 620m [USNM 600399]. Oregon: Harney Co.; Narrows, 2mi S [USNM 511957]; Wasco Co.; Antelope, 7 mi SE [USNM 78859]. Utah: Beaver Co.; Beaver, 3mi E; Mouth of the Canyon of Beaver River [USNM 157952]. Washington: Columbia Co.; Starbuck [USNM 234166].

Sorex haydeni (*n* = 31). — North Dakota: Benson Co.; Fish Lake [USNM 179333, 179429]. Bottineau Co., Bottineau [USNM 186742]; Lower Souris Refuge Marsh [USNM 266472]; no locality? [USNM 288571]. Bottineau/Rolette Co.; Turtle Mountains [USNM 179359, 179360]. Cass Co.; Fargo [USNM 234022, 234023]. Dickey Co.; Oakes [USNM 207601, 209765]. McHenry Co.; near Upham [USNM 266470, 266471]. McKenzie Co.; Williston, S of [Missouri] River [USNM 202240]. Mountrail Co.; 6 mi N of Lostwood [USNM 208215–208217, 208220, 208221, 208223]. Pembina Co.; Walhalla [USNM 233264]. Richland Co.; Blackmer [USNM 207316]; 5 mi NE of Fairmount [USNM 206884]. Roberts Co.; 4 mi S of Blackmer [in Richland Co.] [USNM 209824]. Rolette Co.; St. John, 8 mi N of W Fish Lake [USNM 243272]. Traill Co.; Portland [USNM 75583–75585, 75591]. Ward Co.; Kenmare [USNM 201990, 201992].